Big Test Next Class

Momentum, $p=mv$ units: kgm/s vector
impulse $\Delta p=F_{net}\Delta t$ = area under Fnet -t graph
Collision or explosion - think conservation of momentum $\sum p_i=\sum p_f$ (vector sums) if there are no external force (close, isolated system).
elastic collision - both momentum and kinetic energy are conserved
inelastic collision - stick together.

$m_a v_a+m_b v_b = m_a v_a'+m_b v_b'$ bounce off
$m_a v_a+m_b v_b = m_a v_a'+m_b v_b'$ $1/2 m_a v_a^2+1/2 m_b v_b^2 =1/2\ m_a (v_a')^2+1/2\ m_b (v_b')^2$ elastic
$m_a v_a+m_b v_b = (m_a+m_b)v_{ab}'$ inelastic

Work - Fs if F is in the direction of s = area under the F -s graph (book F -d)
units: Joule, J scalar
Work = change in energy
Power, $P=W/t$
units: Watt, W scalar
efficiency = Wout/Win x 100%
MA=Fout/Fin IMA = sin/sout = Fout/ideal Fin

$E_k=1/2\ mv^2$
$E_g=mgh$

$E_{elastic} = 1/2\ kx^2$ $F_{elastic} = -kx$

Heat, $Q=mc\Delta T$ or $Q=mH$ (book mL)
Thermal equilibrium - same temperature
$Q_A = -Q_B$
$m_A c_A(T_E-T_{Ai}) + ? = -m_B c_B(T_E-T_{Bi})$

Gas Laws
$PV=nRT$
n is the number of moles, 6.02×10^{23} molecules/atoms = 1 mol
$W=P\Delta V$ $P=F/A$
average $E_k = 3/2\ k_B T = 1/2\ mv_{rms}^2$

Hecht Chapter 6, 7,12,13, 14

p535
Q 1, 9, 15, 17

a) $Q = mc\Delta T$

$= 0.0075 \times (130\ \frac{J}{kg\ °C})(327.5°C - 30°)$
0.0095

$= 290J$ or $370J$

b) $Q = mH_f = 0.0075$ or $0.0095 \times 23\ kJ/kg$

0.0095

$= 172.5\text{ J}$

or 218.5 J

c) $Q_1 + Q_2 = \Delta E_K$

$290 + 172 = \frac{1}{2}\begin{pmatrix}0.0075\\0.0095\end{pmatrix} v^2$

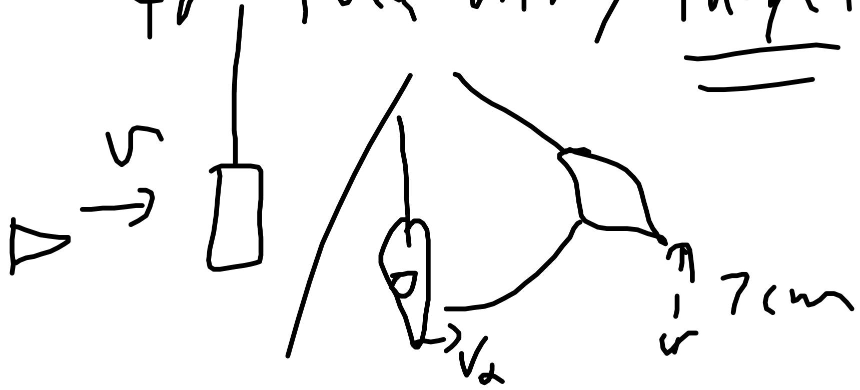
$370 + 218$

$v = 350\text{ m/s}$

d) All $E_K \to$ internal energy

no thermal energy goes to the air / target

e)



Collision p is conserved $mv = (m+M)v_2$

$E_K \to E_g$ swing $\frac{1}{2}(m+M)v_2^2 = (m+M)gh$

$E_K \rightarrow E_g$ swing $\frac{1}{2}(m+M)v_2^2 = (m+M)gh$

$v_2 = \sqrt{2gh}$

$= \sqrt{2(9.8)(0.07m)}$

$v_2 = 1.171\ m/s$

$(0.0075 \text{ or } 0.0095)v = (2.0kg + 0.0075 / 0.0095)1.171$

$v = 313\ m/s$ or $248\ m/s$

f) efficiency $= \frac{W_{out}}{W_{in}} \times 100\%$

$$= \frac{(2kg + 0.0075 / 0.0095)9.8(0.07)}{\frac{1}{2}(0.0075 / 0.0095)\,313^2 / 248^2} = 3.7\% \text{ or } 4.7\%$$

Part 2

$W = P\Delta V$

$W_{A-B} = 9 \text{ or } 6 \times 8 = 72 \text{ or } 48$

$W_{C-D} = 3 \text{ or } 2 \times -8 = -24 \text{ or } -16$

$W_{BC} = W_{DA} = 0$

↑ no S

48 or 32

$\times 10^5 \frac{N}{m^2}\ m^3$

4.8 MJ or 3.2 MJ

b) $\text{eff} = \frac{W_{out}}{W_{in}} \times 100\% = \frac{4.8\text{MJ}}{5.4\text{MJ}}$ or $\frac{3.2\text{MJ}}{3.6\text{MJ}}$

$= 89\%$

c) $PV = nRT$ (nR circled → X)

$PV = XT$

$\frac{P_1 V_1}{T} = \frac{P_2 V_2}{T}$

$$T_2 = \frac{P_2 V_2 T_1}{P_1 V_1}$$

$$T_2 = \frac{(3vv2)\,10\,300K}{(9vv6)\,2}$$

$$\boxed{T_2 = 500K}$$